Doctoral Candidate 8 - Developing a Deep learning-based qMRI method for multi-TE arterial spin labelling MRI

Host Institution	University of Antwerp, Belgium
PhD enrolment	University of Antwerp, Belgium
Primary Supervisor	Prof. dr. Jan Sijbers, imec-Vision Lab
Subject area	Image modelling, acquisition and processing, physics-informed Deep Learning

About this doctoral project and your tasks

You will develop a novel physics-informed deep learning (DL) framework for the estimation of perfusion parameter maps from **under-sampled multi echo-time arterial spin labelling (ASL)** MRI images. These maps can be used to study the permeability of the blood-brain barrier, which is a promising candidate biomarker for early prediction of age-related cognitive decline or neurological diseases. **The framework will leverage** 1) deep image priors to improve the trade-off in quality versus scan-time in quantitative ASL; 2) intra-scan motion to increase the spatial resolution of the perfusion parameter maps; 3) uncertainty quantification of perfusion parameter maps.

Your tasks will include:

- Starting from a profound literature search, staying up-to-date on the state-of-the-art on **ASL perfusion MRI** throughout the PhD trajectory.
- Developing a **forward model** that describes the dependency of the measured ASL images on the perfusion parameters and acquisition settings and accounts for intra-scan motion.
- Developing, training and testing a **physics-informed neural network** for motion-compensated perfusion mapping from under-sampled ASL images, thereby exploring recently emerging deep learning strategies.
- Quantifying the **uncertainty** of the estimated perfusion parameter maps.
- Developing a strategy for **optimal experiment design**.
- Testing the framework on **(pre)clinical MRI scanners**.

Foreseen secondments

For this project, we foresee secondments to:

- Prof. Matthan Caan (3 months) at **Amsterdam UMC** (The Netherlands)
- Prof. Patricia Figuieredo (2 months) at **Instituto Superior Téchnico** (Portugal)